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GAS ABSTRACTS

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CONTENTS

1. Gas Industry 121
2. Appliances 125
3. Combustion and Industrial Furnaces 126
4. Carbonization and Gasification 129
5. Natural Gas and Natural Gas Condensates 134
6. Petroleum and Synthetic Liquid Fuels 140
7. Analytical Methods and Tests 142
8. General and Physical Chemistry 142
10. Chemical Engineering 144
11. Process Equipment and Instrumentation 145
12. Materials of Construction 146
12. Materials of Construction 120
13. New Books 146

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I. GAS INDUSTRY

Cycling Plants

SURVEY OF CYCLING PLANTS. *Oil Gas J.* 47, 157 (1949) *April* 21.

The 48 cycling plants in operation in the United States now have a combined liquid production capacity of 7,194,300 gallons per day of liquid products. This is a 38% increase over the capacity of one year ago. A table lists the names, locations and daily capacities of the nation's cycling plants.

J. C. Lane

Expansion

TREMENDOUS UTILITY EXPANSION PROGRAMS UNDER WAY IN 1949. *Gas* 25, 24-27 (1949) *May.*

Ninety-five major gas utility companies are prepared to spend some $380,000,000 during 1949 for new construction aimed at providing their customers with more gas than ever before. Changeovers to natural gas constitute a major item in the expansion program. Brief descriptions of the construction projects underway are given for individual utility companies.

J. C. Lane

Federal Power Commission

Clark, G. W. RECENT LEGAL, REGULATORY AND LEGISLATIVE EVENTS AFFECTING THE NATURAL GAS INDUSTRY. Paper presented at the Spring Meeting, Natural Gas Department, American Gas Association, French Lick, Indiana, May 9-10, 1949; *Gas Age* 103, 36-38, 64-65, 67-68 (1949) *May* 26.

Among the recent important events in Federal Power Commission regulation have been Opinion No. 166 attempting allocation of Panhandle Eastern Pipe Line Company's capacity, Opinion No. 169 ordering Northern Natural Gas Company to revise its rate schedules to apportion additional natural gas equitably among its gas utility customers, and Opinion No. 175 in which Texas Eastern Transmission Corporation was directed to make available natural gas to nine companies seeking supplies rather than only to three of its existing companies. These three opinions emphasize the vulnerability of private contract provisions when, after hearing, these are found to be in conflict with the requirements of the Natural Gas Act. Docket No. R-107 raised the question of whether private contracts could be overidden without a specific hearing and findings. Order No. 144 amended some of the proposed rules and regulations of Docket No. R-107. However, some differences of opinion concerning interpretation and legality of the rules still exist. Order No. 148 in Docket No. R-110 excluded auxiliary and replacement facilities which would not change delivery capacity from the project types requiring a certificate of convenience and necessity. Opinion No. 168 directed the Kentucky West Virginia Gas Company to reduce its rates after rejecting the contention that the fair field price of gas should be allowed as an operating expense instead of the actual cost of gas produced from the company's own wells. Sale at competitive bidding of debt securities to finance authorized construction was ordered in Docket G-962 involving an application by Tennessee Gas Transmission Company. In Opinion No. 177 authorizing Texas Gas Transmission Corporation and Texas Eastern Transmission Corporation to build interconnected pipe line facilities, the question of competitive bidding on bond issues was again raised, and a suggestion was made that Congress be asked to give the Federal Power Commission comprehensive financial jurisdiction over security issues of natural gas companies. The State Corporation Commission of Kansas recently issued an interim order fixing a minimum price of 8 cents per Mcf for natural gas at the wellhead in the Kansas Hugoton Field. State regulatory commissions have shown the desire to regulate sales by interstate natural gas companies direct to industrial users and consumers within the states involved. After hearings, the Missouri Public Service Commission stated that it now believes that it lacks such jurisdiction. The Illinois Commerce Commission dismissed a test case, but stated that the dismissal was based on special and unusual facts and that, in general, direct sales by interstate pipe line companies traversing the state are a proper subject for control by the Commission. The United States Court of Appeals for the District

of Columbia recently rejected Panhandle Eastern's claim of exclusive rights to serve Detroit and Ann Arbor under the grandfather clause of the Natural Gas Act. The same court also recently ruled that Border Pipe Line Company, since it transports and sells natural gas wholly within the State of Texas, is not engaged in interstate commerce and not subject to Federal Power Commission jurisdiction. The court also critically rejected the Federal Power Commission's interpretation of interstate commerce so as to include foreign commerce, an issue raised by the fact that Border's gas is sold to an industrial company for exportation and consumption in Mexico. The Court of Appeals for the Third Circuit recently held that the Federal Power Commission does not have the power to regulate the transfer of gas leases and denied an injunction to prevent Panhandle Eastern from paying a dividend to stockholders in the form of shares of common stock in Hugoton Production Company. Upon application of the Federal Power Commission, the Supreme Court has granted certiorari, and its forthcoming decision will be an important development for the production and gathering phases of the gas industry. The Court of Appeals of the the gas industry. The Court of Appeals of the District of Columbia has reversed a Federal Power Commission ruling that East Ohio Gas Company was subject to Federal Power Commission jurisdiction and has termed the attempt to assert jurisdiction an "unnecessary, undesirable and unintentional usurpation of regulatory authority of the Ohio Commission." Michigan Consolidated Gas Company and United Gas Pipe Line Company have filed petitions with the Court of Appeals for review of Federal Power Commission Order No. 144 in Docket No. R-107, contending that the Commission is without authority to effect rate changes without a hearing and findings. Cities Service Gas Company has filed a complaint for a declaratory judgment in the U.S. District Court, Kansas, to the effect that the gas price-fixing order of the Kansas Commission is unconstitutional and otherwise invalid. Similar legal arguments are being heard by the Supreme Court of Oklahoma on the validity of the wellhead gas price-fixing order issued by that state's commission. In Congress, bills regarding the scope of Federal Power Commission jurisdiction continue under discussion. The state legislatures of Texas and Oklahoma are considering bills which would impose gathering and severance taxes on the production of natural gas amounting to as much as 2 cents per Mcf. The Oklahoma Senate has passed a bill which would give the Corporation Commission of Oklahoma the power to fix the price of gas at the well. A similar bill has been introduced in the Texas Senate.

J. C. Lane

Linz, B. F. GAS PRODUCERS ASK LEGISLATION TO CLARIFY NATURAL GAS ACT. *Oil Gas J.* **47**, 60, 163 (1949) *April* 14.

Independent producers of natural gas have asked the House of Representatives to take prompt action to define the jurisdiction, if any, of the Federal Power Commission over production and gathering. The recent decision in the Interstate Natural Gas Company case leads them to believe that the FPC may attempt to assert control over producers without affiliation with pipe line companies other than contracts to sell their gas. The risks involved in production are so great and so different from those of a public utility that a producing company cannot survive under regulation as a public utility. Companies which produce both oil and gas are reluctant to contract for sale of their gas to pipe lines because they fear FPC regulation of their operations, which could result in little or no return for their gas production. This has resulted in the capping in of numerous gas wells and the flaring of a considerable quantity of gas. The viewpoints of a number of producing company representatives are quoted, the consensus being that clarification of the FPC's alleged jurisdiction must be accomplished before capital can be obtained for further producing developments and before present producers will accept contracts for sale of their gas.

J. C. Lane

Natural Gas Industry

Larson, E. NATURAL GAS IN NEW ENGLAND. *Am. Gas J.* **170**, 25-28 (1949) *May; Gas* **25**, 42-43 (1949) *May.*

The possibility of the extension of natural gas service to New England is discussed by a representative of one of the country's leading pipe line construction companies. According to his analysis of available reserves, trends in natural gas market expansion, pipe supply, financial and legal aspects and the economic advantages to the New England area, it appears likely that natural gas can, should and will be supplied to the New England states. Present indications are that two or more 26 in. lines, or their equivalent in capacity would be needed to satisfy the area's requirements.

J. C. Lane

WHAT OTHERS THINK—GAS INDUSTRY PROSPECTS. *Public Utilities Fortnightly* **43**, 707-708 (1949) *May* 26.

A nationwide survey of representative gas utilities companies has indicated optimism concerning 1949 business. Sales of gas appliances are expected to be comparable to those in 1948, the all-time record year. Expenditures for advertising gas water heaters will exceed one million dollars, with the American Gas Association furnishing some $110,000 in national advertising, gas water heater manufacturers spending $450,000 and the local advertising of utility companies accounting for the remainder. A new dealer-promotion effort has been initiated. The promotion and advertising activities of American Gas Association's PAR Plan are backed by sound research, much of which is being prosecuted in the laboratories of the Institute of Gas Technology.

J. C. Lane

Natural Gasoline Plants

SURVEY OF NATURAL-GASOLINE PLANTS. *Oil Gas J.* **47**, 149, 151-152 (1949) *April* 21.

The liquid extraction capacity of the nation's natural gasoline plants has increased approximately 35% during the past year. There are 485 plants now operating, with a total capacity of 19,808,775 gallons per day of liquid products. The names, locations and capacities of these plants are tabulated.

J. C. Lane

Nuclear Fission

Hogness, T. R. A SOURCE OF COMPETITIVE ENERGY. *Petroleum Engr.* **21A**, 56, 61, 63-64, 68, 70 (1949) *May.*

Nuclear fission is reviewed as a potential source of energy competitive with coal, petroleum and natural gas for some large-scale uses. In 1946, some 30,000 trillion Btu's of energy were produced in the United States from fuels. This quantity of energy could be supplied from fission of about 1¼ tons of U^{235} per day. However the heavy shielding required renders atomic power unusable for many applications, such as fuel for airplanes, motor cars, trucks and busses. Costs of atomic fuel for feasible applications, such as electrical power stations, are still unknown, but some rough estimates are possible. The cost of mining and refining uranium is expected to approximate $10.00 per pound, which would make the U^{235} content worth $1400 per pound before the cost of separating the U^{235} from the U^{238} is added. This separation cost is certain to be high, because of the elaborate plant investment required. However, it seems probable that it will be possible to employ "waste" neutrons from the controlled reaction of the power pile to convert U^{238} to plutonium at a rate faster than the U^{235} is consumed, thus producing more fissionable material than is consumed in the energy-producing chain reaction. This "breeding principle" is expected to yield an increase of 10% per annum on the atomic fuel utilized in power piles, constantly increasing the fissionable material available to convert more U^{238} or thorium to the fissionable forms. With improved technology and anticipated success of the "breeding principle", it seems possible that atomic energy may almost completely replace coal as a fuel for the generation of electricity. Cheap electricity might be utilized for house heating, and almost certainly would be employed by the nation's railroads.

J. C. Lane

Pipe Lines

Reed, P. GAS-LINE CONSTRUCTION ACTIVITY AT HIGHEST POINT SINCE 1931. *Oil Gas J.* 48, 66-68 (1949) *May* 12.

Natural gas pipe line construction in the United States during 1949 is expected to total 7,000 miles, over 30% more than the mileage laid during 1948. Plans have been announced for 16,500 miles of natural gas lines on which work has not yet been started, making a total of 23,500 miles currently under construction or planned. Tabulations of the principal domestic and foreign gas pipe line projects gives their origin and terminus, length, diameter and current status.

J. C. Lane

HUGE GAS PIPE LINE PROPOSED TO RUN FROM ALBERTA TO CALIFORNIA. *Oil Gas J.* 48, 166 (1949) *May* 19.

Construction of a pipe line to take natural gas from Alberta, Canada, west to the Pacific Coast and south through Washington and Oregon into Northern California is being planned by Pacific Petroleums, Ltd., of Canada, and associated interests. Present plans call for a line 30 in. in diameter and 1,400 miles long.

Excerpt from article

PIPELINE PLANS AND PROGRAMS. *Gas* 25, 95-96 (1949) *May.*

The pipeline construction projects completed or underway during 1948 and underway or planned in 1949 are discussed briefly individually.

J. C. Lane

Rates

Bailey, T. D. ENERGY BASIS COMPARISON OF FUEL-SOURCE COSTS. *Oil Gas J.* 48, 76-78 (1949) *May* 12.

Based on April fuel prices, the costs of one million Btu of energy content at the source compare as follows: natural gas, 5.5 cents; coal, 15.3 cents; residual fuel oil, 16.3 cents; butane 38.7 cents; crude oil, 43.7 cents; No. 2 fuel oil, 52.9 cents; kerosine, 61.5 cents; and gasoline, 74.6 cents. Illustrative of the effect of source prices on delivered prices is the compilation of April wholesale costs per million Btu in Chicago, which range from 11.1 cents for natural gas and 31.2 cents for coal to 61.1 cents for No. 2 fuel oil and 73.1 cents for kerosine, with gasoline the highest cost energy source at 85.7 cents. Of the 34,882 trillion Btu of mineral energy produced in the United States during 1948 at a total cost of $8,535,000,000, coal supplied 45.9% at 30.7% of the total cost, liquid hydrocarbons supplied 36.5% at 65.3% of the total cost, and natural gas supplied 17.6% at 4.0% of the total cost. Our proved natural gas reserves hold approximately 53% of the total energy contained in our proved hydrocarbon reserves, while current production of energy from these reserves is in the ratio of 2 energy units of liquid hydrocarbons to 1 energy unit of natural gas.

J. C. Lane

Ginna, R. E. MUTUAL RATE PROBLEM CONFRONTS ELECTRIC AND GAS UTILITIES. *Gas Age* 103, 29-31, 82, 84, 86, 88, 90 (1949) *April* 28.

The pricing problems confronting electric and gas utility companies are compared, and the need by both types of utility companies for economic research into rate problems is explained. The problem of pricing each type of domestic service equitably from both the customer's standpoint and that of the utility is emphasized. The various loads are analyzed as regards cost to the utility company and value to the customer. Representative charts show the fixed capital, operating expense, gross revenue and gross income of typical gas and electric utility companies during the periods following both World Wars. The service group load characteristics for domestic service are tabulated for both gas and electric utilities, and typical income statements are presented for domestic services rendered by manufactured, natural gas and electric utility companies.

J. C. Lane

The following article, which has not been abstracted, is called to your attention:

NATURAL GAS RESERVES RISE. *Am. Gas Assoc. Monthly* 31, 3-6, 44 (1949) *April.*

2. APPLIANCES

Burners

Clark, J. E. THE CHALLENGE OF THE "NEAT" GAS BURNER FOR FIRES AND COOKERS. *Gas Times* (British) **59**, 118-119 (1949) *April* 22.

The following advantages are claimed for luminous flame burners: (a) silent in operation; (b) reduction in maintenance costs; (c) improved combustion standard, the carbon monoxide-carbon dioxide ratio being in some cases lower than fires fitted with atmospheric burners; (d) penetrative quality of radiation from a "neat" fire greater than obtainable from an aerated burner fire, due to shorter wave length of radiant heat emitted; (e) improvement in distribution of heat, less radiation being directed to hearth and ceiling, and greater intensity being emitted in parts of the room normally occupied; (f) the use of four sizes of jets obviates the necessity for adjustment due to calorific value variation; and (g) on a luminous burner the gas rate falls steadily to balance the rate as the radiants heat up and tends to give a more even heat output.

E. F. Davis

RESEARCH IN PILOT DESIGN, CONSTRUCTION AND PERFORMANCE. Am. Gas Assoc. Testing Laboratories Research Report No. 1123-A (1949) March.

Pilot burner stoppage may be attributed to four major causes: (1) carbon deposits, usually found in the port or orifice of the pilot burner. This deposition occurs from the cracking of hydrocarbons in a fuel gas; (2) copper scale, dislodged from copper tubing and carried by the gas stream and lodged in the pilot burner orifice. This scale occurs from the chemical reaction between the gas and copper tubing; (3) zinc oxide deposits, occurring where brass tubing or burner ports are subjected to elevated temperatures. This oxide scale occurs from the oxidation of the zinc content of the brass; and (4) iron oxide deposits in iron pilot burners which may plug the orifice, port or gasway. It has been found that pilot stoppage can be minimized as follows: (1) by maintaining the temperature of the pilot burner below 500°F, (2) by maintaining a low ambient temperature, (3) by employing a fuel gas with a minimum of unsaturated hydrocarbons or illuminants, and (4) by using yellow brass or aluminum instead of copper tubing for connections.

E. F. Davis

Hill, N. E. and Ress, O. J. (assigned to L. J. Mueller Furnace Co.) GAS BURNER AND MIXING TUBE CONSTRUCTION. U. S. 2,468,331 (1949) April 26.

Claims are made for a gas conversion burner construction which will eliminate extinction noises. By forming the mixing tube into an inverted U tube the gases lighter than air will not flow down the U tube leg after the gas has been shut off.

E. F. Davis

Gas Valve Hood

Mueller, E. H. HOOD FOR GAS VALVES. U. S. 2,469,074 (1949) May 3.

Claims are made for a gas valve hood with an internally threaded elastic insert to prevent gas from leaking at the thread.

E. F. Davis

Space Heating

Mills, D. L., Latart, L. J. and Hutchinson, F. W. RADIANT PANEL HEATING: INFLUENCE OF EMBEDMENT ON UNIFORMITY OF PANEL SURFACE-TEMPERATURE. *Heating & Ventilating* **46**, 73-75 (1949) *May.*

For floor-type panel heating systems of average design there is no appreciable influence on effective performance due to variation of the point surface temperature from the mean surface temperature. Variations of this kind occur due to the cooling of the water as it passes through the coils and also due to the spacing and depth of tube, but the differences are of the order of 3 to 10° F and are not noted by the room occupants. Experimental evidence has been presented to show the influence of depth on uniformity and limited experimental evidence is presented which suggests that variation of surface temperature is very nearly a lineal function of load (at fixed depth).

E. F. Davis

RESEARCH IN FUNDAMENTALS OF HEAT TRANSFER IN CENTRAL GAS SPACE HEATING FURNACES. Am. Gas Assoc. Testing Laboratories Research Report No. 1108, (1949) March.

In general the results obtained to date on this project consisted mainly of development of techniques and means by which final objectives may be obtained. These techniques included methods of instrumentation, furnace operation, data interpolation and correlation, and performance data extrapolation and prediction. Test data obtained and analyzed by these methods conclusively demonstrated the general applicability of these various methods.

E. F. Davis

Water Heaters

Cohen, L. and Jessel, R. FACTORS IN THE DESIGN OF HEAT EXCHANGERS FOR GAS WATER HEATERS. PART I. EFFECT OF RADIATION FROM THE BURNER, AND OF THE GAS-TO-METAL AND THE METAL-TO-WATER HEAT TRANSFER. *J. Inst. Fuel* (British) 22, 209-218 (1949) *April.*

The work described in this paper consists mainly of tests in which steady-state corrosion has been measured by the increase in weight method, the gas rate and composition being maintained as constant as possible throughout the series, and the metal surface kept at a constant measured temperature during each test. In this way it was found possible to correlate metal temperature and amount of corrosion when employing tin-lead coatings of the type now in use in water heaters. Further tests are proceeding with other coatings, and with gas supplies containing varying amounts of sulfur.

E. F. Davis

Kerr, R. and Withers, S. M. CORROSION OF WATER HEATERS BY FLUE GASES. PART I. EFFECT OF TEMPERATURE ON THE CORROSION OF TIN-LEAD COATINGS. *J. Inst. Fuel* (British) 22, 204-208 (1949) *April.*

This investigation of heat exchangers has covered the effects of velocity, temperature and fin spacing, but certain aspects of configuration still remain to be assessed; namely, the effect of pipe spacing and the effect of asymmetry. Other factors calling for investigation are the effects of fin thickness and the use of more than one tier. A study of the former should give results applicable to materials of varying thermal conductivity.

E. F. Davis

3. COMBUSTION AND INDUSTRIAL FURNACES

Combustion

Fehling, H. R. and Leser, T. COMBUSTION WITH OXYGEN AND OXYGEN-ENRICHED AIR. PART II. DETERMINATION OF THE TRUE COMPOSITION OF THE PRODUCTS OF THE THEORETICAL COMBUSTION WITH OXYGEN AND OXYGEN/NITROGEN MIXTURES AT TEMPERATURES UP TO 2,500°C AT ATMOSPHERIC PRESSURE. *J. Inst. Fuel* (British) 22, 123-125 (1949) *February.*

This consideration is confined to the stoichiometric combustion processes involving solid, liquid and gaseous fuels and oxygen or oxygen-enriched air, in which the combustion and dissociation products may consist of CO_2, CO, H_2O, H_2, O_2, OH and N_2 at temperatures up to 2,500°C. The equilibrium composition of the product gases is obtained by a simplified solution of the set of simultaneous equations describing the system. The solution is carried out with tabulated data and only the temperature and CO_2, H_2O and N_2 contents of the undissociated flue gases are required. For part one of this series see *Gas Abstracts* 4, 168 (1948) *September.*

A. J. Rudnitzki

Joyce, J. R. THE ATOMIZATION OF LIQUID FUELS FOR COMBUSTION. *J. Inst. Fuel* (British) 22, 150-156 (1949) *February.*

Following a consideration in some detail of the mechanism, the extent, and basic purpose of atomization, and a reference category by category to the principal types of atomizer available, the pressure jet atomizer is described in detail, attention being called to common faults in design and manufacture. The broad point is then made that liquid-fuel combustion is in-

variably a vapor-phase process, the function of atomization being primarily that of preparing the less volatile liquid fuels for progressive vaporization in suspension in the turbulent air which is its partner in burning. The relatively great importance in liquid-fuel combustion of the small-size spray droplets is emphasized, and an account is given of the process of combustion of an atomized fuel spray. After a general description of the wax method of particle-size measurement, and the determination of the characteristics of a spray in terms of the parameters n and x in the Rosin-Rammler expression reference is made to the various factors—including fuel preheating—which affect the quantity of atomization.

Author's abstract

Roberts, J. THE IGNITABILITY AND COMBUSTIBILITY OF SOLID FUELS. *Coke & Gas* (British) **11**, 59-63 (1949) *February.*

The author criticizes the Critical Air Blast method as too complicated and proposes a new simple ignition and combustibility test for solid fuels, based upon his method described in 1935. The development of the present method is described. The apparatus comprises a fire-clay crucible 5½ in. high by 4 5/16 in. OD, supported on a tripod and heated by a Meker burner at 4 in. W.G., the whole surrounded by insulating brick draft-shields. A miniature brazier basket 1⅝ in. high by 1 5/16 OD, containing 5 grams of ¼ to ⅛ inch fuel is centered on the crucible bottom, with a 650°C thermometer in the coke. A pyrex "chimney" 2 in. ID by 3 ft high is set down over the brazier. The crucible is heated for 40 minutes; the coke residue is cooled, weighed and per cent consumed calculated. The temperatures at which glowing begins, and at which 3 different particles are aglow are noted as "glow point" and "ignition point". Combustibility cannot be determined if ignition point is much above 525°C. The tests agree with results in domestic grate. The author favors better selection of coals to produce free-burning cokes of low ignition temperature.

O. P. Brysch

Silverman, S. and Herman, R. C. THE INFRA-RED EMISSION SPECTRA OF THE OXY-HYDROGEN AND OXY-DEUTERIUM FLAMES. *J. Optical Soc. of America* **39**, 216-218 (1949) *March.*

The infra-red spectra of the O_2-H_2 and O_2-D_2 flames were measured in the region between 1.3 and 20 microns using a prism spectrometer. There is no unequivocal evidence of the presence of the OH radical, all observed lines may be attributed to H_2O.

S. Katz

Silverman, S. THE DETERMINATION OF FLAME TEMPERATURE BY INFRA-RED RADIATION. *J. Optical Soc. of America* **39**, 275-277 (1949) *April.*

Flame temperatures may be determined by measuring with a spectrometer the flame radiation at a characteristic wave length where the emission is pronounced. This is compared with the radiation from a continuous source of known temperature and emissivity and the laws of Kirchoff and Planck are applied. Since the observed radiation comes from a composite flame of inner and outer layers, an average temperature is obtained. Radiation at 2200 cm^{-1} and below originates largely in the hotter parts of the flame and temperatures obtained under these conditions are weighted toward core temperatures. At higher frequencies, the measured temperatures are weighted toward the cooler zones in the flame. Temperatures for the usual hydrocarbon fuels are best measured in the region of 2100 cm^{-1}.

A. J. Rudnitzki

Heating

McCabe, J. C. BUILDING HEATING. *Power* **93**, 71-90 (1949) *June.*

The author gives a complete description of the fundamentals of building heating; he describes how heat is lost from the structure and a method for calculating the heat loss. All of the common methods for distributing heat and the equipment required for accomplishing this are discussed in detail. In addition to the conventional method for central heating the various methods of zone heating are also described.

E. F. Davis

Industrial Finishing

THE CAUSES OF FROSTING OR DULLING ON FINISHES. *Ind. Gas* **27**, 11-12 (1949) *May.*

The causes are given for flat, frosted or dull finishes which occasionally result on material treated in an industrial finishing oven, instead of the glossy surface which was intended. Methods are pointed out for correcting these causes and obtaining successful results from all types of finishing ovens.

E. F. Davis

Pyrometry

Mouzon, J. C. and Dyer, C. A. LOW TEMPERATURE RADIATION PYROMETRY IN INDUSTRY. *J. Optical Soc. of America* **39**, 203-210 (1949) *March.*

The extension of conventional radiation pyrometry into the low temperature range (100-400°F) is discussed. Temperature detection must be made in the infrared. Sensitive thermocouples are the most suitable detectors and fluorite is suitable for the optical systems. The precautions required in the manipulation of this type of instrument are described, and particulars of the construction, operation and performance of a pyrometer are included.

S. Katz

Refractories

Turner, A. A. and Smith, J. M. THE APPLICATION OF SUPER REFRACTORIES TO GAS FIRED INDUSTRIAL KILNS AND FURNACES. *Am. Gas J.* **170**, 40-41 (1949) *May.*

The super refractories constitute a group of products which are made from silicon carbide, aluminum oxide or mullite. The latter is made by high temperature calcination of kyanite, a natural mineral. Temperature alone does not always determine whether a super refractory should be employed, for in numerous instances selection and usage are governed almost entirely by other characteristics such as thermal conductivity, load carrying ability, resistance to abrasion, heat shock and corrosion by molten slag. Silicon carbide is used extensively for lining non-ferrous metal melting furnaces and is noted for its resistance to high temperature, intermittent heatings and cooling, and flame erosion. Mullite is employed where high load carrying strength is required at high temperatures. Mullite withstands very satisfactorily conditions conducive to erosion, spalling and cracking.

E. F. Davis

Utilization

Howe, W. L. INDUSTRIAL USE OF GAS IN LIVERPOOL. *Coke & Gas* (British) **11**, 115-122 (1949) *April.*

The Liverpool Gas Company distributes a 450 Btu/cu ft gas over an area of 100 sq miles. Last year its annual sendout was 3,700 million cu ft which represents an increase of 35% over the sendout in 1933. In 1947 the maximum hourly demand for gas from commercial and industrial users was 170,000 cu ft/hr while in 1948 this demand was increased to 284,000 cu ft/hr. Although there are no large industries in Liverpool the industrial and commercial load results from use of gas in bread baking, varnish melting, tin printing, enamelling, glass bottle manufacture and annealing, space heating and several metallurgical treating plants. One large bakery alone has a maximum hourly demand for 79,000 cu ft gas/hr and it is reported that only 2 therms of gas are required per sack of bread baked (one sack of bread is equivalent to about 370 lb of finished bread). In one of the enclosed batch varnish melting pots the average consumption of gas was reported to be 12.1 cu ft gas per gal of varnish produced, as compared with open pot operation where 18-22 cu ft gas were required for every gallon.

E. F. Davis

4. CARBONIZATION AND GASIFICATION

Carbonization

Gregory, J. and McCulloch, A. LOW TEMPERATURE CARBONIZATION OF ALBERTA SUBBITUMINOUS COAL. *Ind. Eng. Chem.* 41, 1003-1011 (1949) *May.*

Alberta subbituminous coal of 18 to 28% moisture content previously was found by laboratory step-wise carbonization to give a char of maximum calorific value at a carbonizing temperature of 600°C. A pilot-plant Stansfield retort, comprising a vertical stack of sloped carborundum baffle-plates enclosed by refractory-lined vertical combustion flues, was used to carbonize the coal. The flues and plates were preheated to 800-900°C with natural gas; the slack coal was allowed to flow down to fill the baffle-plate column, and as carbonization progressed, the natural gas was shut off and the volatile matter was burned completely by careful regulation of air supply to the flues. When coal throughput exceeded 121 lb per hr, insufficient heat was developed from combustion of the volatile matter to dry and carbonize the coals. The temperatures in the coal fell below 500°C and carbonization could not be maintained. A char of 11,240 Btu/lb (21.6% ash) was made from coal of 8,210 Btu/lb (24.9% moisture, 10.8% ash) in a 76 hr test.

O. P. Brysch

Coal Densities

Franklin, R. E. A STUDY OF THE FINE STRUCTURE OF CARBONACEOUS SOLIDS BY MEASUREMENTS OF TRUE AND APPARENT DENSITIES. PART I. COALS. *Trans. Faraday Soc.* (British) 45, 274-286 (1949) *March.*

The apparent density, true (helium) density, adsorption, porosity, and accessibility of pore space are discussed with relationship to the physical structure of coals. Twelve British coals with carbon content ranging from 95.2% to 80.6% were studied. Coals passing a 72 B. S. (70 U.S.S.) screen were evacuated to below 10^{-4}mm for 16 hrs while heated to 90-100°C, then were exposed to helium for 24 hours. Similarly evacuated coals were also exposed to methanol, water, n-hexane and benzene. True density (helium) decreased with decreasing carbon content from 1.645 to a minimum of 1.293 for an 85% carbon coal, then increased to 1.341 with further decrease in carbon to 80.6%. The apparent densities followed this same pattern. For a given coal the apparent densities in the liquids decreased in the order methanol, water, benzene and n-hexane. Results of porosity and heat of wetting tests indicated that the mean diameter of pores is approximately the same for all coals, but that the *permeability varies,* apparently because of fine constrictions within the pores which reduce the accessibility of the pore space. These constrictions are smallest in coals containing from 89 to 93% carbon.

O. P. Brysch

Coal Hydrogenation

Hirst, L. L. Kastens, M. L. and Chaffee, C. C. LIQUID FUEL FROM COAL. *Ind. Eng. Chem.* 41, 870-885 (1949) *May.*

The Bureau of Mines demonstration coal hydrogenation plant at Louisiana, Missouri, is described in detail. The plant is scheduled to begin operations in May, 1949.

C. H. Riesz

Weller, S., Pelipetz, M. G., Kuhn, M., Friedman, S. and Clark, E. L. HYDROGENATION OF COAL IN BATCH AUTOCLAVES WITH COKE OVEN GAS. *Ind. Eng. Chem.* 41, 972-973 (1949) *May.*

Since hydrogen is a major cost item in the economics of coal hydrogenation, the possibility of using coke oven gas in place of hydrogen was studied in batch autoclave experiments at pressures ranging from 660 to 2120 psi. Pure hydrogen produced a larger degree of liquefaction than did coke oven gas at the same hydrogen partial pressure under various reaction conditions. Ethylene in the coke oven gas was reduced to ethane but hydrogenation of carbon monoxide to methane did not occur. Increase in temperature from 842° to 869°F decreased liquefaction but doubled gasification at hydrogen partial pressures below 1000 psi.

C. H. Riesz

Coal Tar

Green, S. J. and Mukherji, S. M. THE INSOLUBLE MATTER OF COAL TAR. V. COAL TAR RESINS. *J. Soc. Chem. Ind.* (British) 68, 16-19 (1949) *January.*

Hydrolysis, bromination, hydrogenation and dehydrogenation, thermal decomposition and wet oxidation reactions on resinenes from vertical retort pitch show these to be of aromatic nature with alkyl aryl ether linkages. Nitrogen is bound in very stable groupings (as in carbazole), and sulfur in very simple groupings (as hydrosulfides). Anthracene systems, with heavy substituents, and oxygen linkages, are indicated.

O. P. Brysch

Coke Ovens

Hamilton, J. and Kennaway, T. A STUDY OF THE PRESSURE RELATIONSHIPS IN COKE OVENS. *Gas World* (British) 130, *"Supplement"* 47-62 (1949) *May* 7.

Gas pressures were measured on a battery of 8 Simon-Carves coke ovens of chamber dimensions of 17¾ in. width, 40 ft ½ in. length and 11 ft 7½ in. height of charge, with 1 ft gas space, and with double ascension pipes 1 ft 1¾ in. internal diameter and 10 ft high. Pressures were measured at A, collecting main; B, top of ascension pipe; C, base of ascension pipe; D, oven charging holes; E, base of oven doors near wall. With A maintained at 4mm W.G., the pressure at initial, 4th hr, 8th hr, and 16th hr are, respectively, for B, 5.0, 5.0, 5.0, 4.0; for C, 2.0, 1.0, 4.0, 4.0; for D, 2.0, 1.5, 4.0, 2.0; for E 25.0, 1.0, 0.5, 0.5. These conditions were maintained by adjustment of the butterfly valve in ascension pipe progressively throughout the coking period to hold positive pressure at bottom of oven door. With fully-opened butterfly valves the door pressures, initially 25 mm, dropped to zero at 5th hr and to —3.5 mm at 12th hr. Raising the collecting main pressure to 6.0mm caused excessive gas leakage at doors until 8th hr, and final door pressure of —1.5mm. The pressure differentials between the various points are the same, regardless of collecting main pressure.

O. P. Brysch

NORWOOD COKING PLANT. *Coke & Gas* (British) 11, 131-133 (1949) *April.*

Two batteries of 33 twin-flue twin-regenerator underjet ovens were completed by Simon-Carves, Ltd. in November 1947, for the National Coal Board. Oven chamber dimensions are: 40 ft 1 in. by 12 ft 7⅞ in. by 20½ in. with 2 in. taper. The lower portion of the regenerators is of fireclay and the top of regenerators and the oven walls are of high silica. A five-day performance test gave the following results with a five-coal blend from the N-W Durham field. Gross coking time 29 hours 20 minutes, 54 ovens pushed per day, 16 tons coal charged per oven, (13.25 tons coal per oven per day), flue temperature of 1,190°C. Coal of 7% moisture, 23.5% volatile matter, with bulk density of 46 lb at 93.9% passing ⅛ in. screen, gave a gas yield of 12,850 cu ft per ton and coke yield of 77.3% dry. Gas calorific value is 528 Btu per cu ft gross, and specific gravity is 0.364. Underfiring requires 36.25% of gas yield, or 1028 Btu per lb coal of 7% moisture. The coke is sold for blast furnace and foundry use and the gas for town gas.

O. P. Brysch

Distribution

Hall, F. J. RENEWING SERVICES WITH COPPER TUBING. *Gas Age* 103, 24-25, 58-59 (1949) *May* 12.

The chief advantages of using copper tubing for renewing services are: (1) appreciable savings in the total cost of the job, including material costs; (2) a large reduction in manpower requirements; (3) the work is done with a minimum of disturbance to the customer and the public; and (4) twelve years experience with this type of installation indicates that the life of copper will be longer than steel pipe. A complete description of the installation procedure is given.

E. F. Davis

Veltfort, T. E. EXPERIENCES WITH COPPER TUBE IN GAS SERVICES AND MAINS. *Gas* 25, 32-37 (1949) *May.*

Copper tubing and pipe have been used successfully for new and replacement gas services in Baltimore, Cincinnati, Richmond, Pitts-

burgh, Detroit, and Chicago. In some areas where the sulfur content of the gas is high the copper is tin plated to prevent internal corrosion of the tubing. A variety of fittings such as Dresser couplings, soft solder fittings, flare fittings and brazed joints have been employed. A complete description of the installation procedure in various localities is outlined.

E. F. Davis

Gas Condensing Plant

Francombe, R. W. and Grant, A. G. THE SELECTION AND DESIGN OF GAS CONDENSING PLANT. *Gas J.* (British) 258, 342, 345-349 (1949) *May* 11.

The authors discuss the indirect water-tube type of condenser only, with emphasis from a management viewpoint upon the specification of the duty and requirements to be met and the selection of appropriate equipment. The duty must be determined from full information on gas volume and temperature fluctuations and on water temperatures. Selection of plant then must include consideration of economic factors, such as (1) capital, maintenance and depreciation charges, (2) running costs (water cost), and (3) gas pressure loss, as well as technical factors such as design of tube arrangement, stagewise operation, and standby capacity. Tabulations showing performance flexibility of a modern condenser, and cost of water cooling are appended.

O. P. Brysch

Gasification

Arthur, J. R., Bangham, D. H. and Thring, M. W. COMBUSTION IN FUEL BEDS. *J. Soc. Chem. Ind.* (British) 68, 1-6 (1949) *January.*

The elementary theory of the coke-burning producer which teaches that the fuel bed comprises 2 zones, (1) an oxidizing bed in which the fuel is burned directly to CO_2, and (2) a reducing zone in which CO_2 is converted into CO endothermically, has been found by BCURA experiments from 1939 to 1946 to be insufficiently accurate to explain the results. The experiments with sloped-grate fuel beds and single channels of carbon show that in the first few particle thicknesses of the bed most of the carbon consumption is complete; i.e., the ratio of carbon consumed by a given amount of air to the maximum carbon consumable by complete conversion of the oxygen to CO, quickly attains a value of 0.5. Water-cooled gas sampling probes were incapable of chilling the gas-phase reaction of CO and O_2 and no CO was found; but addition of chlorine-bearing inhibitors to the primary air stopped this reaction and indicated that much CO was present initially and that carbon was being consumed at great depths in the bed. The CO, in uninhibited conditions, is therefore consumed in the void space between the first few layers of fuel bed particles by gas-phase reaction with excess oxygen. The "down-jet furnace" offers a practical means of attaining complete combustion without excessive air.

O. P. Brysch

Peak Load

Hall, E. L. CATALYTIC REFORMING AND THERMAL CRACKING. Paper presented at the Spring Meeting, Natural Gas Department, American Gas Association, French Lick, Indiana, May 9-10, 1949; *Gas Age* 103, 27-31 (1949) *May* 26.

Expanding usage of natural gas thrusts upon the gas industry increased responsibility in meeting peak loads. While storage of natural gas has been found practical, local conditions may not be favorable for this solution. The separation of ethane and/or propane from natural gas and storage of these high Btu content materials is suggested. Generation of peak load gas at costs comparable to the delivered price of natural gas is a desirable objective. Modern gas production practice is reviewed. Catalytic cracking has been found attractive for emergency use because of its flexibility, low capital cost, low labor charges and other features. In plant-scale tests, the Hall process has shown substantial savings in oil consumption over other oil gas methods but its greatest value lies in the ability to gasify high carbon oils. Based on oil at $1.20 to 1.80 per bbl, 1000 Btu oil gas may be produced in existing equipment at a net cost of 30 to 50 cents per Mcf.

C. H. Riesz

Sulfur

Hoffert, W. H. and Wendtner, K. REACTION OF SULFUR, HYDROGEN SULFIDE, AND MERCAPTANS WITH UNSATURATED HYDROCARBONS. *J. Inst. Petroleum* (British) 35, 171-192 (1949) *March.*

This article comprises a literature survey treating the following topics: (1) formation of sulfur-containing sludge from wash oil used for benzole recovery; (2) formation of sulfur, H_2S, and mercaptans during the refining of benzoles; (3) action of sulfur on ethylene, acetylene, cyclo-olefins, styrene, diolefins, and higher olefins; (4) action of H_2S on unsaturated hydrocarbons, i.e., vapor-phase reaction under pressure, liquid-phase reaction in the presence of acids and bases, and the effect of ultra-violet light; (5) thermal decomposition of mercaptans, sulfides and disulfides; and (6) addition of mercaptans to unsaturated hydrocarbons. Reaction temperatures, catalysts, and other pertinent conditions are discussed in some detail. The relationship of the various reactions to commercial processes is indicated in each case. A tabulation of 113 literature references is included.

H. Hakewill

Synthesis Gas

Greene, F. C. (Assigned to In Situ Gases Inc.) GENERATION OF SYNTHESIS GAS. U. S. 2,466,945 (1949) April 12.

A process for the generation of synthesis gas, particularly by the combustion in situ of coal, lignite, or oily deposits, which comprises the pre-preparation of 2 parallel separated inlet-ducts by mining horizontally from outcrops into said carbonaceous deposit, these 2 ducts converging together at a suitable distance within the deposit. A single outlet duct is prepared between them to terminate at the point of convergence of the inlet ducts and to form acute angles with these ducts. Air blowers, arranged to discharge into the surface openings of the inlet ducts, may be surcharged with steam and oxygen. A surface exhauster sucks away the gases which are produced by combustion of the coal at the acute angles of the juncture of inlets and outlet ducts, these gases passing through the collapsed burning embers on their way outward through the outlet duct. Petroleum can likewise be recovered from deposits, as synthesis gas or as distilled vapors.

O. P. Brysch

Underground Gasification

Bouring, J. R. and Sterling, E. SOME RECENT EXPERIMENTS ON UNDERGROUND GASIFICATION. *Bull. Brit. Coal Utilization Research Assoc.* 13, 37-43 (1949) *February.*

Since the war, results have been published on underground gasification of coal at four locations other than Russia: (1) Gorgas, Alabama: (January-March, 1947). Coal Seam (Pratt) was 35 in. thick, horizontal; coking coal, 31% V.M, 51% F.C. 14% ash; overburden was 30-45 ft of layered shale + fireclay. Ignition began at the bottom of U-shaped gallery and moved toward top in the center-coal panel. Air inlet and gas offtake were at opposite legs of the U and were reversed periodically. Air at 7350 CFM (at 2 psi) gave 108 cu ft/lb coal with 46.8 Btu/cu ft. Oxygen-enriched air gave gas of 50.5 Btu/cu ft. Steam, O_2 + air gave gas of 109.5 Btu, steam with O_2 alone gave 134.5 Btu, and steam alone gave 200 Btu/cu ft. 236 tons coal were gasified and 164 tons carbonized. (2) Valdarno, Italy: (July, 1947). Low-grade lignite seam was 16 to 40 ft thick, sloping 15° to 20°, with 13% ash, 40% water; overburden 31-39 ft of carbonaceous hard clay. Ignition began at bottom of U-shaped gallery and the combustion was confined along bottom of U by steel doors on air-inlet side of U and by water sprays on the gas-outlet side. Air at 565,000 cu ft/hr and 23.5 inches H_2O was blown without reversal. (This air-rate was believed inadequate for optimum gas production). After the roof collapsed, gas Btu rose from 56 to 96 Btu. Reduced air-blast gave a distillation gas of 237.2 Btu/cu ft. Most favorable blast and steam yielded 112.4 Btu/cu ft gas and an 18-day average run gave 94.3 Btu/cu ft gas. Under the last two conditions the output was 5.3 million cu ft/24 hr, consuming 130 tons lignite/24 hr. (3) Terni, Italy: (November, 1947). Lignite seam was 5.9 ft

thick, sloping 10°; with clay and sandstone overburden. Shafts followed the dip of the seam and were joined by horizontal gallery. With reduced air blast a large fire-front could be maintained yielding gas of 92.6 Btu/cu ft and with higher blast a 45 Btu average was obtained. Leakage interfered with the experiment and new workings were planned. (4) Wandre, Belgium: (February, 1948). Coal seam was 4 ft thick, inclined 80°; 11% V.M., 82.6% F.C; 3% ash. Channels forming a U-shaped gallery about 600 ft deep by 230 ft wide were subjected to six series of tests. Successful control with no leakage was obtained. Gasification followed the trend of the Italian experiments. The author refers to 27 articles published from 1943 to 1948, including Demart's claimed 5-fold reduction in electricity cost per kwhr for gas fuel as compared to solid-fuel steam generation.

O. P. Brysch

Vertical Retorts

Kerr, H. SOME FACTORS INFLUENCING THE LIFE OF VERTICAL RETORTS. *Gas Times* (British) 54, 29, 31-33, 36-37 (1949) *April* 8.

The life of vertical retorts depends largely on the type of coal, particularly the ash content, ash fusion point and expanding properties of the coal, the rate of coal throughput and the calorific value of the retort gas. Widespread formation of scurf usually accompanies an operation producing a high calorific value gas. Scurf or carbon deposition on the retort walls is conducive to spalling of silica brickwork. Scurf can be minimized at the bottom of the retort by the addition of steam, a procedure which results in a low gas heating value due to dilution of the retort gas with the products of the water gas reaction. Serious damage to both retort walls and combustion flues can result from fused ash attack. Retort gas leakage into the combustion flues, causing overheating, represents perhaps the major factor in bringing about expensive repairs. The importance of adequate supervision and early attention to necessary repair work is stressed.

C. Von Fredersdorff

Water Gas Conversion

Christain, D. C. and Boyd, P. B., Jr. WHAT TO LOOK FOR IN CO CONVERSION CATALYSTS. *Chem. Eng.* 56, 148-150 (1949) *May.*

For the water gas shift reaction, the catalyst selected should be not only active but also durable. Laboratory tests of five catalysts, varying widely in chemical composition are discussed. The method of manufacturing a suitable catalyst, admittedly a major factor contributing to activity and durability, is not discussed.

C. H. Riesz

Sherwood, P. W. DESIGN OF WATER GAS CONVERSION PLANTS. *Petroleum Engr.* 21C, 20, 23-24, 26, 29-30 (1949) *May.*

The water gas shift reaction is of particular importance in the manufacture of high purity hydrogen. Practical operating temperatures vary between 750 and 925°F. Promoted iron catalysts are used industrially and are not affected by the usual catalyst poisons, such as chlorine, phosphorus, alkali, etc. Appreciable quantities of hydrogen sulfide reduce catalytic activity but small amounts of organic sulfur are not harmful. Since there is no volume change in the reaction, pressure does not affect the equilibrium. However, appreciable compression and steam savings are possible at elevated pressures. Multi-stage operation, plant design features and purification methods are also discussed.

C. H. Riesz

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Hoppe, H. M. REPAIRING JOINT LEAKS BY INTERNAL APPLICATION. p. 134

Howell, H. G. REMOTE PRESSURE CONTROL BY TELEMETERING. p. 134

Lauderbaugh, A. B. STORAGE OF GAS TO MEET PEAK LOADS. p. 136

Roberts, J. THE IGNITABILITY AND COMBUSTIBILITY OF SOLID FUELS. p. 127

5. NATURAL GAS AND NATURAL GAS CONDENSATES

Distribution

Hoppe, H. M. REPAIRING JOINT LEAKS BY INTERNAL APPLICATION. *Gas Age* **103**, 49-53, 90 (1949) *April* 28; *Gas* 25, 38-41 (1949) *May*.

The problem of repairing leaking bell and spigot joints in cast iron pipe without a complete excavation has been studied and one solution is reported for large diameter pipe. This method consists essentially of compressing a rubber gasket to the surface of the pipe at the joint by means of cast iron rings shaped like piston rings. The larger joints, wider than ⅛ in., are first caulked with a lead wool, then sealed with a rubber-base plastic putty before the gasket is applied.

B. E. Hunt

Howell, H. G. REMOTE PRESSURE CONTROL BY TELEMETERING. *Gas Age* **103**, 44-48, 82 (1949) *April* 28.

A description is given of the remote pressure control system being installed on gas distribution lines in Memphis. The pressure control valves are actuated by electrical impulses originating from the dispatcher's office. The electrical impulses are carried by telephone cable. In addition, the pressures at remote portions of the distribution system are transmitted to the central board. Eventually, it is planned to have a total of 60 remotely operated control valves and about 30 pressure check points.

W. J. Merwin

Menet, W. J. EFFECT OF NATURAL MIXTURES ON METERS IN PRODUCTION PLANT. *Gas Age* **103**, 28-30, 60 (1949) *May* 12.

See *Gas Abstracts* 5, 105 (1949) *May* for abstract.

Hypersorption

Berg, C., Fairfield, R. G., Imhoff, D. H. and Multer, H. J. HYPERSORPTION. *Oil Gas J.* 47, 95, 97, 130, 132, 135 (1949) *April* 28.

In the Hypersorption process, a gaseous mixture is pased upwards through a descending bed of activated carbon. The activated carbon has a 12-30 mesh range when charged and commercial operation has shown virtually no deterioration in activity, absorber oil and polymers of diolefins being removable by regeneration procedures. The first commercial plant at Midland, Michigan, has consistently recovered 98% of the ethylene contained in a demethanizer column overhead. Other applications of the hypersorption process are discussed. These include propane recovery from natural gas, removal of nitrogen from natural gas, purification and desulfurization of synthesis gas, separation of methane and hydrogen chloride and recovery of hydrogen from ammonia synthesis purge gases.

C. H. Riesz

LP-Gas

Metzner, A. B. and Taylor, J. A. NATURAL GAS AS AN ADMIXTURE FOR PROPANE. *Gas Age* **103**, 31-33, 62, 64 (1949) *April* 14.

The system natural gas-propane has been investigated at sub-zero temperatures and the feasibility of adding natural gas (essentially methane) to propane gas for the prevention of pressure loss at low temperatures has been shown. A curve to show the percentage of natural gas remaining in a closed system as the system is diminished has been drawn, as have the Pressure vs. Temperature curves for various compositions of this system.

Authors' abstract

Sidenfaden, W. R. TWO WAYS TO BALANCE LOAD. *Butane-Propane News* **11**, 52, 54, 57-58, 61-62, 64 (1949) *May*.

By computing the average monthly sale of LP-gas over the period of a year a dealer can determine the amount of gas in excess of this average that must be stored during periods of high demand which generally occur in January, February, and March. Storage space must be

provided for the total yearly excess gas and it is proposed that the storage can be constructed on the dealer's premises at less cost to the dealer than it can be installed on the customer's premises.

E. F. Davis

Natural Gasoline

Ames, C. B. and Tabbert, T. D. ETHANE AND PROPANE SEPARATION GREATLY SIMPLIFIED AT DUBACH. *Petroleum Refiner* 28, 117-122 (1949) *May.*

A plant recovering 80% propane from wet gas at flowing pressure of 2700 psi is described. A feature is chilling both gas and lean oil to 60° F, the gas being first dehydrated with florite. This permits use of an absorption oil of low molecular weight, 155, and reduces oil pumping 50%. This, in turn, correspondingly reduces the sizes of oil coolers, exchangers, pumps and vent tanks. Also the rich oil need be heated to only 410°F in place of the usual 500 to 550°F of a high pressure plant, which permits a further reduction in size of oil exchangers and reduces the size of the stills and condensers. The low temperature decreases the amount of methane and ethane absorbed by about 25%, reducing the sizes of the still, reabsorber and recompressor. Absorber pressure is 900 psi and rich oil is flashed to 425 psi and then to 200 psi before being sent to the still. The high pressure still operates at 155 psi and uses enough agitation steam to remove the butanes. This partially denuded oil is sent to a low pressure fractionating still at atmospheric pressure which removes moisture and eight hydrocarbons. Detailed flow sheets are presented.

J. D. Parent

Bailey, W. F. REVISION PROGRAM COMPLETED AT OLD OCEAN UNIT GASOLINE PLANT. *Oil Gas J.* 48, 284-287, 290, 292 (1949) *May* 19.

The Old Ocean unit gasoline plant has been somewhat revised. A flow sheet and process details are given. Whereas the old unit's highest absorption pressure was 1,250 psi it is now 1,800 psi due to addition of another absorber. A propanizer-reabsorber helps to cut down the vapor load on the still. A dual still is employed.

J. D. Parent

Bryant, W. T. "COMBINATION GASOLINE PLANT" GOES ON STREAM AT SILSBEE. *Petroleum Refiner* 28, 128-132 (1949) *May.*

A detailed flow sheet and description is presented of the Silsbee field gasoline plant operated by American Republics Corp. The plant is unique in that gas is utilized from different sources at different pressures. It furnishes gas for high pressure cycling operations, for gas-lift operations and to a gas transmission pipe line. Gas enters the plant at 35, 150, 300, 600, 900 and 2000 psi and the capacity is 60 MMcf/d. This plant is an example of the flexibility that can be built into an absorption plant.

O. T. Bloomer

Garrison, M. E. HIGH LP-GAS RECOVERY AT NEW CALIFORNIA PLANT. PART II. *Petroleum Engr.* 21C, 13-14, 16, 18, 20 (1949) *April.*

The author completes the discussion of a plant for high propane recovery. Calculations and flow sheets are given.

J. D. Parent

Glendening, A. S. and Sanderson, C. F. SHORT CUT PROCESS DESIGN TO INCREASE PROPANE RECOVERY IN GASOLINE PLANTS. V. MULTI-STAGE DISTILLATION. *Petroleum Processing* 4, 530-534 (1949) *May.*

A two stage absorption oil distillation system is described. The rich oil is fed to a high pressure still which makes a "sloppy" cut, and the bottoms are sent to a low pressure still which takes liquid overhead and allows the lean oil to leave at the bottom. The overhead from the high pressure still goes to a surge tank where the liquid is sent to fractionators and the vapor is sent to a recompressor. The advantages of a two stage distillation system are: (1) a relatively small amount of surge tank vapors are evolved; (2) process steam consumption is low; and (3) the equivalent of single still operation is obtained without an increase in utilities. The operating pressure of the high pressure still

ranges between 100 and 200 psi, while that of the low pressure still ranges between 10 and 40 psi. The methods of control of process are illustrated and described and an outline of the method of calculation is given.

W. J. Merwin

Stopford, J. TWO ABSORPTION PLANTS USE EXISTING EQUIPMENT FROM THIRD. *Petroleum Refiner* 28, 123-126 (1949) *May.*

Equipment from Hunt Oil Company's Long Lake Recycling Plant taking gas from a field which had reached its depletion point was utilized to construct two absorption plants. One plant is for the Lisbon Field in Louisiana and the other for the Harleton Field in Texas. More than 60% of the equipment in the new plants came from the old plant. A detailed flow sheet and some operating details of the Lisbon plant are presented.

O. T. Bloomer

Thornton, D. P., Jr. HOW TO INCREASE PROPANE RECOVERY. SIX CASE HISTORIES. I—WARREN PETROLEUM CORPORATION. II—SKELLY OIL COMPANY. III—GREGG-TEX GASOLINE CORP. IV AND V—SHELL OIL COMPANY. VI—TEXAS NATURAL GASOLINE CORP. (NEW PLANT). *Petroleum Processing* 4, 519-524 (1949) *May.*

Case histories for increased propane recovery procedures adopted by some plants are given. In general the tendency is toward increased absorber pressure, lean oil chilling and intertray absorber cooling. The Gregg-Tex plant at Longview is extremely interesting in that an absorber was not formerly used. Gas to the deethanizing recovery tank ahead of the newly installed absorber is chilled to 0°F. Hydrates are avoided by diethylene glycol injection. This reagent is recovered by settling of the tower bottoms. The Texas Natural plant at Abilene, Texas, is new and is noteworthy in that it has a 90% propane recovery.

J. D. Parent

Peak Load

Lauderbaugh, A. B. STORAGE OF GAS TO MEET PEAK LOADS. Paper presented at the Spring Meeting Natural Gas Department, American Gas Association at French Lick, Indiana, May 9-10, 1949; *Gas Age* 103, 39-41, 68, 70 (1949) *May* 26.

From the standpoint of ease in startup, flexibility and simplicity of operation, and the production of a gas interchangeable in any proportion with natural and manufactured gases, propane-air has achieved wide recognition as a standby fuel. Gas companies, particularly of the Appalachian area, have been confronted with an extreme winter peak-load problem attributable largely to the low price of gas compared to other fuels and to the depletion of local gas fields with the result that more gas is required from long distance pipe lines. In order to minimize the effect of the "demand factor" of the natural gas rate structure on the price paid for natural gas, it has become feasible to install propane-air plants for peak-load shaving. It is recognized that from the cost standpoint most natural gas companies cannot afford to make more than 2% of their total annual sales as propane-air gas, but that, although expensive, peak-load shaving can save a sum sufficient to pay for the propane-air plant within 3 to 5 years. Typical cost estimates for plant and propane storage are included.

C. Von Fredersdorff

Pipe Lines

Maradudin, A. P. QUALITY CONTROL OF FABRICATION AND INSTALLATION OF HIGH YIELD STRENGTH PIPE LINES. Paper presented at the Spring Meeting, Natural Gas Department, American Gas Association, French Lick, Indiana, May 9-10, 1949.

The author describes the quality control methods of Standard Oil Company of California used in fabricating the 18 in. o.d. Kettleman-Los Medanos pipe line in 1946. Initially each heat of steel from the foundry was checked for carbon, manganese, phosphorus, and sulfur. During fabrication of the pipe, inspection of the weld was stressed and a 4 in. test ring was cut from the finished pipe for physical tests. This

was done for each heat and the entire heat was passed if the test proved satisfactory. Several physical tests were run on the test specimen. Guided face bend, guided root bend, nick break, tensile (both parallel and at right angles to the weld), hardness, and impact tests were run. Coupons were cut from the weld metal for macroscopic and microscopic examination. Gamma and x-ray inspection was also used. The complete specifications for quality control of welding methods, inspections and testing in the field are given. In conclusion the author states that gamma and x-ray inspections are expensive and hard to interpret and that visual inspection by qualified personnel in connection with tensile and nick break tests are almost as satisfactory.

W. G. Bair

Richardson, F. E. MODERN GAS PIPE LINE CONSTRUCTION METHODS INCLUDING SHORT COMMENT ON SPECIFICATIONS AND INSPECTION. Paper presented at the Spring Meeting, Natural Gas Department, American Gas Assoc., French Lick, Indiana, May 9-10, 1949.

The development of modern pipe line construction methods since about 1920 is traced. General comments are provided for specifications on each phase of line construction.

J. D. Parent

Woodard, K. SHALLOW WATER REPAIRS MADE BY REGULAR CREWS. *Gas* 25, 102 (1949) *May*.

A description is given of the special equipment and procedures used by regular crews to repair under-water pipe lines if located less than 15 ft below the surface. A rubber face piece similar to that used by aviators for high altitude flying was adopted.

O. T. Bloomer

Production

Bryant, W. T. SILSBEE GAS-PROCESSING PLANT PERFORMS WIDE VARIETY OF FUNCTIONS. *Oil Gas J.* 48, 250-251, 253, 256-257 (1949) *May* 19.

Gas at six different pressures is treated in the plant. Some gas is recycled at 4,000 psi, some is used for gas lift, while some is sold. Liquid products are propane, butane, motor fuel, kerosine and mineral seal oil. No gas is flared. Absorber pressures are 2,000, 900 and 600 psi. A high pressure still and an evaporator-dephlegmator at lower pressure are employed for oil regeneration. A flow sheet is given.

J. D. Parent

Calhoun, J. C., Jr. ENGINEERING FUNDAMENTALS: VISCOSITY OF A RESERVOIR GAS. *Oil Gas J.* 48, 119 (1949) *May* 12.

For an ideal gas the viscosity is independent of pressure and increases as the temperature is raised. For natural gas there is a distinct increase in viscosity as the pressure is raised and the viscosity drops with increase in temperature at pressures in excess of about 1,000 psi. This is all based on the original work of Bicher & Katz, *Trans. A.I.M.E.* 155, 246 (1944).

J. D. Parent

Foster, T. R. COMMERCIAL APPLICATIONS OF CENTRIFUGAL COMPRESSORS AND THE COMPLEMENTARY AXIAL. Paper presented at the Natural Gas Spring Meeting of the American Gas Association, French Lick, Indiana, May 9-10, 1949.

The principal commercial applications of large volume high speed centrifugal compressors of one manufacturer have been in compressing air from atmospheric to about 100 lbs, in compressing propane in refrigeration service, and in pipeline booster station service. Possible applications of axial flow compressors and their characteristics as compared with centrifugal compressors are briefly discussed.

O. T. Bloomer

Fuellhart, H. W. FIVE-SPOT FALLACY IN SECONDARY RECOVERY. *Oil Gas J.* 47, 65-66, 68 (1949) *May* 5.

The fallacy of symmetrical patterns for injection wells in the secondary recovery of oil is pointed out. A hypothetical pool is analyzed and it is concluded that injection wells should be located in areas and focal points of relatively low permeability. This condition usually occurs in the edge of the field. The additional desired condition of highest oil saturation occurs in the same areas.

O. T. Bloomer

Guyod, H. CAN RESISTIVITY METHOD DISCOVER OIL DIRECTLY? PART II. CONCLUSION. ACTUAL DEPTH-RESISTIVITY CURVES. *World Oil* **129**, 73-74, 77 (1949) *May.*

The author concludes that surface resistivity measurements cannot lead directly to oil discovery. The method, however, is valuable, particularly in conjunction with geological data.

J. D. Parent

Jones, E. N. ACIDIZING TECHNIQUES IN SAND FORMATIONS. PART II. CONCLUSION. *World Oil* **129**, 156, 158, 160, 162, 164 (1949) *May.*

In the second part of this article the effects of acids on cements are discussed. The acidizing of cores under pressure using an apparatus similar to a permeability tester is briefly mentioned. The use of acids before cementing is vaguely described and possible benefits are mentioned. The procedure for acidizing a well by swabbing are outlined. Several examples of benefits obtained by acidizing are included.

O. T. Bloomer

Murray, W. J. NATURAL GAS PROBLEMS IN THE TERRITORY OF GREATEST RESERVES. Paper presented at the Spring Meeting, Natural Gas Department, American Gas Association, French Lick, Indiana, May 9, 1949.

More important problems affecting the production of natural gas in Texas are discussed. Topics included are price at the wellhead, restrictions on exports from the state, uniform standards of measurement, regulations, conservation, and ratable take. Most attention is given to progress and trends in the conservation of gas, particularly casinghead gas. Tables are presented which give a comparison of gas flared in March, 1945, with that flared in March, 1949, for all casinghead gas plants reporting to the Railroad Commission of Texas. In 1945 over 300 MMcf per day were flared as compared to 47 MMcf per day in 1949.

O. T. Bloomer

Neslage, F. J. RESULTS OF GAS INJECTION IN WEST PAMPA DOLOMITE RESERVOIR. *Oil Gas J.* **47**, 71-72, 90, 93 (1949) *May* 5.

Results to date are presented of the repressurizing program to improve oil and gas recovery from the West Pampa Dolomite reservoir. Recovery figures cannot be given as yet, but the normal oil and gas decline has been retarded. Credit for approximately half the gain is attributed to an acidization program.

O. T. Bloomer

Nielsen, R. F. and Menzie, D. E. FACTORS AFFECTING PRODUCTION BY AIR-GAS DRIVE. *World Oil* **129**, 144-146, 148 (1949) *May.*

Results are presented of laboratory studies on the effect of liquid viscosity and core length on the production history of an air drive. Below 80% oil saturation (shortly after the gas phase has broken through at the producing end) the behavior may be predicted without regard to the continuity equation. The gas volume required to reduce the saturation by a fixed amount is proportional to the viscosity of the oil. Experiments on long cores confirm this relationship.

O. T. Bloomer

Remke, M. A. RESUMÉ OF GAS-REPRESSURE OPERATIONS IN LARIMORE FIELD, YOUNG COUNTY, TEXAS. *Oil Gas J.* **47**, 62-63, 90 (1949) *May* 5.

The production history of the Larimore field in North Central Texas is reviewed. Gas pressure operations were commenced early in the development of the field and have resulted in a total recovery to date of 56½% of the oil in place as compared to the estimated primary productions of 35%. An intensified gas injection program is now being undertaken to give increased recovery.

O. T. Bloomer

Rose, W. THEORETICAL GENERALIZATIONS LEADING TO THE EVALUATION OF RELATIVE PERMEABILITY. *J. Petroleum Technol.* **1**, (*Trans. Section*) 111-126 (1949) *May.*

Theoretical expressions are presented to describe wetting and non-wetting phase relative premeability relations. These expressions have then been compared with existing published data, the conformance noted being sufficiently good to satisfy the requirements of some engineering use. As a consequence, it may be supposed that relative permeability characteristics of porous media now can be inferred from basic core analysis data, in a manner more convenient (although less direct) than presently available methods of experimental evaluation.

Author's abstract

Storage

Spangler, C. V. A NEW WAY TO STOCK PILE NATURAL GAS. *Oil Gas J.* **47**, 94-96, 99, (1949) *May* 5.

Stock piling of methane as gas adsorbed on Fuller's earth at very low temperature is advocated. After purification, gas would be cooled to about —250°F and brought into contact with the adsorbent. Some form of refrigeration would be applied to maintain this temperature until regeneration would be required. A small elevation in temperature would effect desorption and liberation of the gas, which would be heated to atmospheric temperature prior to admission to the distribution system. An adsorption isotherm for methane at —250°F and an adsorption isobar for a total pressure of 800 mm Hg are presented. Optimum operating conditions are not as yet known; however, it is indicated that a temperature of about —250°F would be used. Safety is thought to exceed that of the liquefaction process. Due to the difference in adsorbability of nitrogen and methane some separation may be effected.

J. D. Parent

Abstractor's Note: Below —245°F, the adsorption isobar of methane rises steeply indicating capillary condensation, while surface wetting by ordinary liquefaction will occur at the normal boiling point of —258°F. This means that the heat of adsorption if not actually the heat of condensation must be removed. These heat quantities are of the same magnitude and would have to be removed at a very low temperature. Intensive gas chilling to effect storage would be required, and a system to maintain the very low storage temperature would have to be devised.

Transmission

Barry, A. F. MECHANICAL REMOVAL OF FREE WATER FROM HIGH PRESSURE GAS LINES TO PREVENT FORMATION OF HYDRATES. *World Oil* **129**, 137-138, 140, 142 (1949) *May.*

The author describes the water knockout device used by the Superior Oil Company to eliminate hydrate formation in their gathering line from the wells. The knockout consists primarily of a baffle plate and a constant level device so that condensate floating on top of the water level can be returned to the main gas stream. The water knockout is operated at 1800 psi. The knockout operated satisfactorily during the winter of 1948-1949 and part of this time line temperatures were well below hydrate formation temperatures. In fact, the knockout could probably be operated for considerable periods at temperatures below hydrate forming temperatures. Operating data are also presented.

W. G. Bair

Hull, D. E., Kent, J. W. and Lee, R. D. RADIOACTIVITY IN PIPE LINE FLOW STUDIES. *World Oil* **129**, 187-188 (1949) *May.*

A solution of an oil soluble radioactive barium salt (Ba^{140}) was injected in a pipeline at the interface between two stocks. The presence and distribution of the radioactive material at some distance down-stream was used to determine the extent of intermixing of the two successive stocks. It is suggested that applications of the technique to pipe line moistening procedures are very promising, and are simple, non-hazardous and inexpensive.

S. Katz

Mosteller, W. C. THE FLOW EFFICIENCY OF A 30 In. O.D. NATURAL GAS TRANSMISSION LINE BASED ON OPERATING DATA OBTAINED FROM THE CALIFORNIA SECTION OF THE TEXAS-PACIFIC PIPE LINE. Paper presented at the Spring Meeting, Natural Gas Department, American Gas Association, French Lick, Indiana, May 9-10, 1949.

The friction term in the general (isothermal) flow equation was replaced by Nikuradse's expression for smooth pipe, and a multiplier type of correction factor was inserted in the equation to correct for the lack of smoothness in the line. This correction factor or flow efficiency term was found to be about 86.5% for the California end of the "biggest inch" line.

J. D. Parent

Skinner, E. T. PRESSURE SURGES IN PIPE LINES. *World Oil* **129**, 196, 198, 200 (1949) *May.*

The author outlines the three causes of pressure surges; valve closure, suction line surges, and discharge line surges. If these surges get in phase pressure build up can easily destroy equipment. These surges can be relieved by use of stand pipes or surge tanks. However, for petroleum lines these methods are not satisfactory. Use of centrifugal pumps will cut down surging but cannot pump heavy oils at low temperatures. The other method of control would be to use wave interference. By proper design of suction and discharge manifolds or by use of two pumps on the same prime mover, the pressure surges could be spaced 180° out of phase and would eliminate each other.

W. G. Bair

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Hall, E. L. CATALYTIC REFORMING AND THERMAL CRACKING. p. 131

Hall, F. J. RENEWING SERVICES WITH COPPER TUBING. p. 130

Veltfort, T. E. EXPERIENCES WITH COPPER TUBE IN GAS SERVICES AND MAINS. p. 130

6. PETROLEUM AND SYNTHETIC LIQUID FUELS

Fischer-Tropsch Synthesis

Barr, F. T. HYDROCARBON SYNTHESIS. U. S. 2,467,802 (1949) April 19.

For the synthesis of liquid hydrocarbons from carbon monoxide and hydrogen, two or more fluidized catalyst reactors are used in series. Catalyst withdrawn from the last reactor is fed to the next to last reactor and so on until catalyst is rejected from the first reactor. Fresh synthesis gas is contacted first with catalyst of lowest activity and is contacted in the series of reactors with catalyst of successively higher activity. Fresh or regenerated catalyst is entered in the last reactor. The catalyst may be either of the cobalt or iron type.

C. H. Riesz

Griffin, L. I. Jr. (assigned to Standard Oil Development Co.) HYDROCARBON SYNTHESIS. U.S. 2,468,494 (1949) April 26.

In the production of organic products by the reaction of carbon monoxide and hydrogen by means of the fluidized catalyst technique, catalyst fines are recovered from the exit stream by oil scrubbing. After separation from the oil by filtration, these fines as well as a portion of catalyst withdrawn from the reactor are treated with liquefied petroleum gas (e.g., liquefied butane) to extract high molecular weight products which have been adsorbed by the catalyst. The extracted catalyst is returned to the reactor.

C. H. Riesz

Herbst, W. A. (assigned to Standard Oil Development Company) SYNTHESIS OF HYDROCARBONS. U.S. 2,467,803 (1949) April 19.

The carbon-forming tendencies of hydrocarbon synthesis catalysts are reduced by contacting fresh catalyst with the tail gases from the main synthesis operation. Any suspended carbon or fines in this aged catalyst are removed by a classification. The classified, aged catalyst is then used in the primary reactor system where

a major portion (60 to 90%) of the reaction occurs.

C. H. Riesz

Layng, E. T. (assigned to Hydrocarbon Research, Inc.) CATALYTIC SYNTHESIS OF HYDROCARBONS. U.S. 2,465,465 (1949) March 29.

In the synthesis of liquid hydrocarbons from carbon monoxide and hydrogen, the residue gases containing carbon dioxide and hydrogen are reacted in the presence of synthesis catalyst to form methane and water. The methane may be reacted with oxygen to form part of the synthesis gas for the process.

C. H. Riesz

Owen, J. J. (assigned to Standard Oil Development Co.) PRETREATMENT OF GASES FOR SYNTHESIS OF HYDROCARBONS. U.S. 2,468,510 (1949) April 26.

In the catalytic synthesis of liquid hydrocarbons from carbon monoxide and hydrogen, the feed gases are desulfurized by passage over a metal contact which does not form carbonyls under the desulfurization conditions. Copper and molybdenum are claimed specifically as active desulfurizing metals. A contact comprising 65% by weight of reduced copper and 35% by weight of alumina is cited as an example.

C. H. Riesz

Ruthruff, R. F. CATALYTIC CONVERSION OF FISCHER-SYNTHESIS PRODUCT. U.S. 2,467,407 (1949) April 19.

Liquid hydrocarbons prepared by the catalytic hydrogenation of carbon monoxide and boiling above the gasoline range are cracked into high octane gasoline in the presence of synthetic magnesium silicate catalysts containing from a trace up to about 1% of zeolitic sodium oxide. It is stated that silica-alumina catalysts are much less effective than the silica-magnesia catalysts for the cracking of synthetic hydrocarbon liquids boiling higher than gasoline.

C. H. Riesz

Scharmann, W. G. (assigned to Standard Oil Development Co.) SYNTHESIS OF HYDROCARBONS. U.S. 2,467,861 (1949) April 19.

In the synthesis of liquid hydrocarbons from carbon monoxide and hydrogen using a fluidized bed of iron-type catalyst, the fluidized catalyst mass is comprised of a major proportion (75-95% by weight) of catalyst with low carbon-forming properties (e.g., reduced iron pyrites ashes) and a minor proportion (25-5%) of active catalyst (e.g., an active ammonia synthesis catalyst of the iron type) with high carbon-forming tendencies. It is claimed that high catalytic activity as well as low catalyst carbonization and disintegration can be obtained by the above means.

C. H. Riesz

Warner, B. R. (assigned to Gulf Research & Development Co.) HYDROCARBON SYNTHESIS. U.S. 2,467,282 (1949) April 12.

The process of synthesizing liquid hydrocarbons from carbon monoxide and hydrogen through use of gallic acid-precipitated iron catalysts (see U.S. 2,467,283) is claimed.

C. H. Riesz

Warner, B. R. (assigned to Gulf Research & Development Co.) FISCHER-TROPSCH CATALYST AND ITS PREPARATION. U.S. 2,467,283 (1949) April 12.

An improved iron catalyst is claimed for the synthesis of liquid hydrocarbons from carbon monoxide and hydrogen. The catalyst is prepared by adding a water-soluble alkaline compound (e.g., potassium carbonate) to an aqueous solution of an iron salt (e.g., ferric nitrate) up to the point of incipient precipitation (i.e., pH of 2.1 to 2.3 for ferric salts), then adding gallic acid to the mixture in such amount that the mole ratio of gallic acid to iron salt is at least 0.08 to 1, thereby obtaining a precipitate which is recovered for use as a catalyst.

C. H. Riesz

Production

Rose, W. and Bruce, W. A. EVALUATION OF CAPILLARY CHARACTER IN PETROLEUM RESERVOIR ROCK. *J. Petroleum Technol.* **1**, *Trans. Section*, 127-142 (1949) *May.*

Improved apparatus, methods, and experimental techniques for determining the capillary pressure-saturation relation are described in detail. In this connection a new multi-core procedure has been developed which simplifies the experimental work in the study of relatively homogeneous reservoirs. The basic theory concerning the Leverett capillary pressure function has been extended and has been given some practical application. Some discussion is presented to indicate the relationship of relative permeability to capillary pressure, and to provide a new description of capillary pressure phenomena by introducing the concept of the psi function.

Authors' abstract

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Edmister, W. C. APPLICATIONS OF THERMODYNAMICS TO HYDROCARBON PROCESSING. p. 143

Kobe, K. A. and Long, E. G. THERMO-CHEMISTRY OF THE PETROCHEMICAL INDUSTRY. p. 143

7. ANALYTICAL METHODS AND TESTS

Carbon Monoxide Determination

Lindsley, C. H. and Yoe, J. H. ACIDIMETRIC METHOD FOR DETERMINATION OF CARBON MONOXIDE IN AIR. *Anal. Chem.* **21**, 513-515 (1949) *April.*

A method for the determination of low concentrations of carbon monoxide, depending upon oxidation of the CO to CO_2 by passage over hopcalite catalyst and measurement of the CO_2 formed by acidimetric means is described. The CO_2 is absorbed in 0.005 molar barium hydroxide solution and excess alkali is measured by titration with standardized oxalic acid solution. It is claimed that the method is suitable for determining CO concentrations as low as 0.005% with 0.001% accuracy. Comparison of values obtained by this method with values obtained by the iodine pentoxide method and with known values for samples supplied by the National Bureau of Standards demonstrates the accuracy claimed.

H. Hakewill

Infra-Red Gas Analyzer

Fowler, R. C. A RAPID INFRA-RED GAS ANALYZER. *Rev. Sci. Instruments* **20**, 175-178 (1949) *March.*

An infrared gas analyzer employing an undispersed beam is described. The instrument is unusually rapid, very sensitive to concentration change, and relatively insensitive to moderate pressure and temperature variations. It has been employed in the analysis of CO_2, CO, ether, acetylene and other gases.

S. Katz

8. GENERAL AND PHYSICAL CHEMISTRY

Mass Spectrometer

Kinder, J. F. and Wertzler, R. THE MASS SPECTROMETER—A TOOL FOR THE PETROLEUM PROCESSOR. *Petroleum Processing* **4**, 515-518 (1949) *May.*

The mass spectrometer is capable of rapid and accurate analysis of many refinery streams and other mixtures encountered in petroleum processing and research. Types of materials which have been analyzed by one refinery include stream of C_1 through C_5, pilot plant samples through C_7, miscellaneous aromatics, flue gases, compounds containing sulfur and others. Average elapsed time of 1½ hours per sample is shown to compare favorably with 6 to 8 hours required by some older methods. Methods of handling samples, the instrument, maintenance, and calculations which have been proved satisfactory by three years of experience are described.

D. V. Kniebes

Spectroscopy

Hibbard, R. R. and Cleaves, A. P. CARBON-HYDROGEN GROUPS IN HYDROCARBONS. *Anal. Chem.* **21**, 486-492 (1949) *April.*

The characterization of paraffin hydrocarbons in terms of the degree of chain branching is facilitated by measurements of the "concentrations" of the functional groups in the near infrared. Data obtained for simple members of a hydrocarbon class are transferable to the more complex members. Numerous applications to refinery control problems are described.

S. Katz

Thermodynamics

Edmister, W. C. APPLICATIONS OF THERMODYNAMICS TO HYDROCARBON PROCESSING. PART 18—ENTROPY CHARTS FOR HYDROCARBON MIXTURES. *Petroleum Refiner* **28**, 157-166 (1949) *April.*

A procedure for preparing Mollier diagrams for hydrocarbon mixtures is described. In the computation of thermodynamic properties of hydrocarbon mixtures, it is recommended that the effect of temperature be computed by the summation of ideal gas state properties. The effects of pressure are best treated by the application of generalized correlations to the mixture, using the pseudo-critical of the mixture. The approximate nature of the generalized mixture methods is pointed out.

S. Katz

Franklin, J. L. PREDICTION OF HEAT AND FREE ENERGIES OF ORGANIC COMPOUNDS. *Ind. Eng. Chem.* **41**, 1070-1076 (1949) *May.*

Tables showing ΔF° and ΔH° which were calculated from equations involving $(H^\circ - H_0^\circ)/T$ and $(F^\circ - H_0^\circ)/T$ at various temperatures for various structural groups of hydrocarbon molecules are presented in this article. From these tables, values for ΔF° and ΔH° may be obtained at various temperatures for many hydrocarbon molecules. It is useful for hydrocarbon molecules whose thermodynamic data is not available in the literature.

S. Mori

Kobe, K. A. and Long, E. G. THERMOCHEMISTRY OF THE PETROCHEMICAL INDUSTRY. PART IV. CYCLOPARAFFINIC HYDROCARBONS. *Petroleum Refiner* **28**, 161-163 (1949) *May.*

The best available specific heat, enthalpy, free energy of formation, heats of formation and heats of combustion data have been carefully compiled and selected for four cycloparaffinic hydrocarbons. The enthalpy and specific heat data are tabulated against four different temperature scales from the freezing point of H_2O to the temperature corresponding to 1200°C. The freezing point of water is used as a datum point for the enthalpy scale.

S. Mori

Souders, M., Jr., Matthews, C. S. and Hurd, C. O. RELATIONSHIP OF THERMODYNAMIC PROPERTIES TO MOLECULAR STRUCTURE. *Ind. Eng. Chem.* **41**, 1037-1048 (1949) *May.*

Heat capacities and enthalpies of hydrocarbon vapors and common gases are tabulated between temperatures of —250 to 3000°F. The data for the hydrocarbon vapors were obtained from a method that depends on the molecular structure. Calculations can be made by adding the vibrational and internal rotational energies of the different structural groups, which make up the hydrocarbon molecule, to the translational and external rotational energies of the molecule itself. Comparison with modern experimental methods show deviation of less than 3%.

S. Mori

Souders, M., Jr., Matthews, C. S. and Hurd, C. O. ENTROPY AND HEAT OF FORMATION OF HYDROCARBON VAPORS. *Ind. Eng. Chem.* **41**, 1048-1056 (1949) *May.*

Entropies and heats of formation for hydrocarbon molecules may be calculated by assignment of definite values to various structural groups that make up the molecule. These values may also be obtained for higher temperatures by knowing their increase in the vibrational, rotational, and translational energies. Tables

giving all of these data for various structural groups are included for temperatures from 300 to 2000°K.

S. Mori

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Fehling, H. R. and Leser, T. COMBUSTION WITH OXYGEN AND OXYGEN-ENRICHED AIR. p. 126

Joyce, J. R. THE ATOMIZATION OF LIQUID FUELS FOR COMBUSTION. p. 126

Silverman, S. THE DETERMINATION DF FLAME TEMPERATURE BY INFRA-RED RADIATION. p. 127

Silverman, S. THE DETERMINATION OF RED EMISSION SPECTRA OF THE OXY-HYDROGEN AND OXY-DEUTERIUM FLAMES. p. 127

10. CHEMICAL ENGINEERING

Cooling Towers

Pfeifer, E. L. WHAT SIZE COOLING TOWERS? *Chem. Eng.* 56, 98-100 (1949) *April.* See *Gas Abstracts* 5, 117 (1949) *May* for abstract.

Distillation

Bowen, J. R. APPARATUS FOR FRACTIONAL DISTILLATION UNDER REDUCED PRESSURE. *J. Chem. Ed.* 26, 186-187 (1949) *April.*

A glass fractional distillation apparatus of extremely simple design is described. Several useful features include the Schirm type of condenser, uninterrupted distillation while changing the receiver and ease of variation of distillation pressure.

S. Katz

Feldman, J., Myles, M., Wender, I. and Orchin, M. EVALUATION OF VACUUM RECTIFICATION COLUMNS. *Ind. Eng. Chem.* 41, 1032-1036 (1949) *May.*

Two binary test mixtures (n-dodecane and cyclohexylcyclopentane, and n-tridecane and dicyclohexyl) were studied in equilibrium stills at various subatmospheric pressures (20 mm to 350 mm of mercury) for use in determining the efficiency of fractionating columns. The use of the mixtures for column evaluation are restricted to columns of less than 20 plate efficiencies at 20 mm of mercury.

H. Dirksen

Sherwin, D. S. MULTICOMPONENT RECTIFICATION. *Chem. Eng. Progress* 45, 342-348 (1949) *May.*

A method is proposed for stepwise tray calculations involving enthalpy balances. An equation is proposed which leads to dependable and more rapid evaluation of vapor rates.

J. D. Parent

Mass Transfer

Hixson, A. W. and Smith, M. I. MASS TRANSFER IN LIQUID-LIQUID AGITATION SYSTEMS. *Ind. Eng. Chem.* 41, 973-978 (1949) *May.*

An equation is derived for a liquid-liquid extraction system assuming the existence of two films, constant interfacial area under constant conditions, immiscible liquids, and a mean effective constant distribution coefficient. From this equation, plotting log of 1 minus the fractional approach to equilibrium vs. time should give a straight line, the slope of which is a measure of agitation efficiency. The equation was verified using the system water-iodine-carbon tetrachloride. Glass vessels 14.6-25.0 cm in diameter were used with a ratio of vessel to propeller diameter averaging 2.0. Agitation rate varied from 80 to 400. Extraction rate increases with increasing speed of agitation and increasing vessel size.

C. L. Tsaros

Pilot Plants

Ridgway, J. A., Jr. STANDARD DESIGNS FOR PILOT UNIT EQUIPMENT. *Ind. Eng. Chem.* 41, 1082-1085 (1949) *May.*

Sketches and descriptions are presented of units of pilot plant equipment. These items include: a high temperature electric heater; a low temperature electric heater; a heat exchanger; a proportioning sampler for gases; a liquid displacement meter; a reactor closure; and a stuffing box.

W. J. Merwin

11. PROCESS EQUIPMENT AND INSTRUMENTATION

Fluid Flow Measurement

Anderson, J. W. and Friedman, R. AN ACCURATE GAS METERING SYSTEM FOR LAMINAR FLOW STUDIES. *Rev. Sci. Instruments* 20, 61-66 (1949) *January.*

A metering system is described which may be used to measure gas flows between 0.002 and 2 cu ft per minute with an accuracy of 0.3%. The system employs interchangeable sets of sapphire orifices operated at critical velocities. The procedure used in calibrating the meter is described in detail.

S. Katz

Instrumentation

Hammond, C. E. THE USE OF PRESSURE AND VOLUME INSTRUMENTS IN THE GAS INDUSTRY. *Gas Times* (British) 59, 110, 112, 114 (1949) *April* 22.

The author lists the principles to be followed in choosing and using instruments. Briefly, the factors to be considered are range, accuracy, indicating recording, location, and design. Each of these points is briefly discussed.

W. J. Merwin

Rotameters

Howard, W. B. THE CALCULATION OF ROTAMETERS. *Petroleum Refiner* 28, 131-134 (1949) *April.*

A discussion of the various shapes of rotameter floats is presented and a series of design equations are given.

W. J. Merwin

Martin, J. J. CALIBRATION OF ROTAMETERS. *Chem. Eng. Progress* 45, 338-342 (1949) *May.*

Procedures to be followed in rotameter calibration are set forth.

J. D. Parent

Pipe Stress Analysis

Lewaren, S. W. PIPE STRESS ANALYSIS . . . FOR THERMAL EXPANSION. *Oil Gas J.* 47, 80, 82-84, 87-88 (1949) *May* 5.

The author presents a method for determining thermal stresses in pipe runs which are of such type that ordinary graphical analysis is not practical. The method uses the elastic center concept and is based on the principle of the simple cantilever beam. Simple arithmetic is involved and the calculations can be tabulated. It is claimed that this method reduces the calculation time appreciably.

W. J. Merwin

The following article, which has not been abstracted, is called to your attention:

Nelson, W. L. COSTIMATING CENTRIFUGAL PUMPS. *Oil Gas J.* 47, 103 (1949) *May* 5.

12. MATERIALS OF CONSTRUCTION

Corrosion

Costanzo, F. E. NEW MOBILE TOOL CUTS CATHODIC PROTECTION COSTS. *Gas Age* 103, 32-34 (1949) *April* 28.

The author describes the cathodic protection truck developed by the Pittsburgh group companies as mobile tool for cathodic protection work throughout the 5 state territory served by the group. The various items with which the truck is equipped, such as auger, power winches, chemicals mixing tank, and wire laying plows, are described in some detail. By an investment of $4500 on this mobile unit the daily installation of anodes by a two man crew rose from 4 to 30.

B. E. Hunt

Horst, R. L., Reid, K. K. and Verink, E. D., Jr. CORROSION CONTROL BY METAL ANODES. *Southern Power & Ind.* 67, 56-59 (1949) *May.*

This paper, the first of a series, discusses corrosion control by the use of cathodic protection. Various sources of current, such as rectifiers, motor driven generators, wind driven generators, and galvanic anodes are described. The subject of galvanic anodes of zinc, magnesium, and aluminum, is expanded and discussed more fully than are the other current sources.

B. E. Hunt

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Kerr, R. and Withers, S. M. CORROSION OF WATER HEATERS BY FLUE GASES. p. 126

Turner, A. A. and Smith, J. M. THE APPLICATION OF SUPER REFRACTORIES TO GAS FIRED INDUSTRIAL KILNS AND FURNACES. p. 128

13. NEW BOOKS

Coal Chemistry

Kreulen, D. J. W. ELEMENTS OF COAL CHEMISTRY. Rotterdam-s-Gravenhage, Nijgh & Van Ditmar, N. V., 1948.

This book, in English, is presented as a second edition, entirely rewritten, of Kreulen's book "Grundzüge der Chemie und Systematik der Kohlen", (1935). Its stated object is first to introduce the student to the literature of the specialized branches of coal chemistry, and second to express the author's views developed during 25 years of coal research. The opening chapter is a brief general description of the ranks and types of coals based upon their lithological, chemical and physical properties. This prepares the reader for the second chapter which treats of coal classification and the properties upon which it is based in the German, French, Belgian, British, and American systems. Geological, botanical and chemical conditions which govern the formation of peat and coals are next summarized from European literature. The review of the chemistry of humic acids and their relationship to coal formation (the author's specialty) is an excellent guide to this extensive body of literature, some of it quite controversial, which is still actively growing. Carboniferous plant life is briefly described. Petrographic constituents and their chemical properties are discussed and the terminology is explained. Here the author pleads for more study on accurately separated constituents. At this point the author leaves the more general aspects of coal chemistry and in chapters 9, 10 and 11, he returns to a detailed discussion of his favorite field, the humic content of coals. He first correlates this with the volatile content and coalification. He then describes in detail his studies of oxidation of coal to form humic acids at lower temperatures (260°C), and also explains his use of the Arrhenius equation to calculate the energy of activation, which expresses the humic-acid-forming property of the particular coal. This equation is used also to show the existence of an intermediate stage in the formation of the

acids from high-rank coals. The reaction by which carbon dioxide and water are formed at lower temperatures is shown to proceed independently, and without an intermediate stage. The ignitibility of coals, also investigated extensively by Kreulen's crossing-temperature method, was found to occur at higher temperatures when "humic-acid" oxidation had first taken place. The chapter on coking properties comprises brief comments on plasticity in general, and methods of testing including agglomerating, agglutinating, Foxwell's gas-flow, dilatometer, penetrometer, plastometer, devolatilization, and free and restricted swelling. The relationship of results of several of these tests to rank and petrographic composition of the coal is discussed, but the modern, large-scale American test ovens are not mentioned. Brief resumés are given of the several important studies of the extraction of bitumen fractions of coal by organic solvents. These extraction studies are then related in the final three chapters to recent work on micellar structure of coals by the author and others. The author's theory of a dispersable coal micelle comprising a humin nucleus closely associated with protective bodies of oily bitumens originating from humic acids, is supported by his data from dioxane extractions. He also reevaluates the extraction data of other investigators from the basis of surface tension of the solvent (dispersing medium), and concludes that much of their "bitumen" extract was really dispersed humic matter. His study of the oily portions of coal extracts leads him to conclude that they are formed in different amounts and composition in peat, brown coal and coking coal by "bituminization" of humic compounds peculiar to each rank. The oily bitumen appears to contain the *coking* (cementing) component, while the humic dispersed phase of coal extracts contributes the *swelling* component, thus the system as a whole is needed to give a complete, proper coke formation. Finally, from his studies of solvents, Kreulen considers that hydrogenation of coal is probably preceded by fusion and dispersion of the coal to form a heavy liquid. The American coal researcher may be disappointed at the predominance of references to European literature, which number 191 in a total of 234. However, the author explains that he has been forced to omit many, but has selected from the best general studies. 32 of the 43 American citations are on plasticity, hydrogenation, ignition and humic acids. The book therefore should be useful in America chiefly as a review of European opinions on fundamentals of coal chemistry. The book is stimulating in that it reviews older work, once very controversial, and fits much of it together to explain in a quite reasonable way the results of modern work by the author and others. By doing this it exposes the vast gaps in our knowledge of the chemistry of coal. There are a few typographical errors, but the book is an excellent example of quality printing and illustrating.

O. P. Brysch

Diesel Engines

Hegh, C. THE CYLINDER WEAR IN DIESEL ENGINES. Brooklyn, N. Y., Chemical Publishing Company, Inc., 1949.

The author brings together the published information on the subject of diesel engine cylinder wear up to 1940. The topics covered include: piston rings, lubrication, fuel ignition and combustion, temperatures, corrosion, material and surface treatment, operating conditions and type of engine. An addendum is presented on wear in large marine diesel engines. The author concludes that the steps which can be taken to reduce cylinder wear are as follows: provide proper lubrication; improve the design; avoid corrosion and remove abrasives; improve combustion; and develop wear resistant cylinder liners.

W. J. Merwin

Gas Notebook

Terrace, J. NOTEBOOK FOR GAS ENGINEERS AND STUDENTS. London, Ernest Benn Limited, 1948.

This is a book of about 950 pages devoted to the problems of the manufactured gas industry. It is an English publication, written by a past president of the Institution of Gas Engineers, and reflects English practices and problems primarily. Topics treated include foundations for buildings, petrology of coal, coal, coke, car-

bonization, plant layout, carburetted water gas, gas conditioning, by-products, gasholders and related subjects. It should be interesting to all concerned with plant layout.

J. D. Parent

Petroleum Production

Jones, P. J. PETROLEUM PRODUCTION. V. 5. OIL PRODUCTION BY GAS AND FLOODING. New York, Reinhold Publishing Corporation, 1948.

Displacement of oil from reservoirs by gas and by water are the prime considerations of this book. Fundamental considerations are presented in order to supply the necessary background.

J. D. Parent

Reviewer's Note: Unfortunately, a large number of equations are presented both without derivation and without reference to original sources. This limits the value of the book considerably.

Trade Marks

Bennett, H. TRADE-MARKS. Brooklyn, N. Y., Chemical Publishing Co., Inc., 1949.

The importance of the trade-mark in merchandising a product makes its selection worthy of careful consideration. The trade-marks of reliable companies have come to indicate standards of value of their products, and well known, respected trade-marks are assets of incalculable value to many companies. In the Gas Industry, this fact is best appreciated by the appliance manufacturers who have had experience in competitive merchandising. If and when chemicals from gas are marketed extensively, another field for trade-mark use by the industry may be opened. Bennett's book compiles the legal aspects of trade-marks in easily read form and presents valuable information concerning factors to be considered in coining them. Of particular interest is the section on methods of selecting an effective trade-mark, a section which should serve as a helpful guide to one faced with this task. The four general types of trade-marks are as follows: (1) a firm name or its modification; e.g., Reznor, Servel, and Goodrich; (2) a synthetic or coined word which is indirectly descriptive; e.g., Hot-Point, Fiberglas, and Duriron; (3) an ordinary word or words which are not descriptive (in sense of function); e.g., Reliable, Lucky Strike and Quaker, and (4) a synthetic word that is not descriptive; e.g., Drene, Lux, and Pep. Pronounceability, ease of remembrance, pleasing sound and connotation are among the desirable features of an effective trade-mark. To aid the prospective trade-mark originator, Bennett has discussed experience-tested methods for attaining these and other desirable features.

J. C. Lane

The following bulletins of the Institute of Gas Technology Research Bulletin Series are called to your attention. A limited number of copies of these bulletins are available for free distribution to Associate Members of the Institute of Gas Technology, while others may obtain them for the price indicated. Address the Director, Institute of Gas Technology, Technology Center, Chicago 16, Illinois.

No. 1 Storage of Natural Gas as Hydrate, by Joseph D. Parent. 1948. $2.50.

No. 2 Equilibrium Compositions and Enthalpy Changes for the Reactions of Carbon, Oxygen and Steam, by Joseph D. Parent and Sidney Katz. 1948. $10.00.

No. 3 Supplying Household Heating Services by High Temperature Circulating Liquids and Vapors, by Edward F. Davis, Joseph J. First and Ralph E. Peck. 1948. $2.50.

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